CLAIMS

1. Data processing apparatus for determining optimum parameters of a model of a physical system, the apparatus comprising:
   (a) obtaining means for obtaining at least one initial string of values representing the parameters of the model to be optimised;
   (b) first determining means for determining a cost value associated with the model having parameters represented by the or each string of values;
   (c) generating means for repeatedly generating a new string of values by selecting a sequence of values of random length, starting at a random position in a said string of values, replacing a sequence of values of the same length in a said string of values at a random position, and changing the value of one or more of the values of the resulting string of values to generate a new string of values;

   wherein said first determining means is adapted to determine a cost value associated with the model having parameters represented by the new string of values; and

   (d) second determining means for determining the optimum parameters as one of said initial or new string of values for which the cost value associated with the model having the optimum parameters is closest to a target.

2. Data processing apparatus according to claim 1 wherein said generating means is adapted to consider a last value

in a said string of values as being sequential to a first value in said string of values such that said selected sequence of values can include said last and first values sequentially in a said string of values and the sequence of values to be replaced can include said last and first values sequentially in a said string of values.

3. Data processing apparatus according to claim 1 ~~or claim 2~~, wherein said obtaining means is adapted to randomly obtain values for said at least one initial string of values.

4. Data processing apparatus according to Claim 1 ~~any preceding claim~~ wherein said obtaining means is adapted to obtain a plurality of said initial strings of values to form a population, and said generating means is adapted to perform a genetic algorithm on said population by repeatedly generating a new string of values by

(a) selecting a sequence of values of random length starting at a random position in a first said string of values,

(b) replacing a sequence of values of the same length in a second said string of values at a random position, and

(c) mutating the value of one or more of the values of the resulting string of values to generate said new string of values.

5. Data processing apparatus according to claim 4, wherein said generating means is adapted to repeatedly

(a) delete a proportion of the population for which the cost values are furthest from said target, and

(b) perform said repeated generation of new strings of values until the population is regenerated; and

(c) to select said first and second strings of values randomly from the undeleted proportion of the population for which the cost values are closest to said target.

6. Data processing apparatus according to claim 4, wherein said generating means is adapted to repeatedly

(a) randomly select three said strings of values from said population,

(b) select two of the selected strings of values for which the cost values are closest to the target as said first and second strings of values, and

(c) replace the third of said selected strings of values with the generated new string of values.

7. Data processing apparatus according to Claim 1 ~~any one of claims 1 to 3~~, wherein said obtaining means is adapted to obtain a single said initial string of values.

8. Data processing apparatus according to claim 7, wherein said generating means is adapted to repeatedly replace said single string of values with said new string of values if the cost value associated with the model having said new string of parameters is closer to said target.

9. Data processing apparatus according to claim 8 wherein said generating means is adapted to repeatedly replace said parent string of values with said new string of values if the exponential of the difference in the cost values for said parent string of values and said new string of values divided by a factor dependent upon the number of repetitions by said generating means is greater than a random number between 0 and 1.

10. Data processing apparatus according to Claim 1 ~~any one of claims 1 to 9~~, wherein the parameters include configuration parameters of a physical system, the apparatus further comprising control means for controlling the configuration of a physical system in accordance with optimum configuration parameters.

11. Data processing apparatus according to claim 10 including means for receiving operating parameters from said physical system such that the model of a physical system is adapted to model said physical system using the received operating parameters.

12. Data processing apparatus according to Claim 1 ~~any one of claims 1 to 9~~, further comprising control means for configuring a distributed database, the distributed database comprising a plurality of data servers connected over a network, each data server holding any number of data units, and a plurality of clients connected over the network to the data servers, each of said clients being adapted to retrieve data units from and/or update data units at one or more of the data servers, wherein the parameters of the model to be optimised include

configuration parameters defining which data server is to be accessed by which client, and the first determining means is arranged to utilise the configuration parameters and information on the passage of data within the distributed database to determine a cost value, said control means being arranged to control which data server is to be accessed by which client in accordance with determined optimum configuration parameters.

13. Data processing apparatus according to claim 12, wherein said control means is adapted to copy, move and/or delete data units at data servers to change the distribution of the data units across the data servers and/or to change the data servers to be accessed by said clients using the determined optimum configuration parameters to improve the system performance.

a 14. Data processing apparatus according to claim 12 ~~or claim 13~~ wherein said first determining means is adapted to b determine said cost value in dependence upon the time taken for one or more said clients to retrieve and/or update data units at one or more data servers.

15. Data processing apparatus according to claim 14, wherein the first determining means is adapted to determine said cost value as any one of: the longest response time for any said client to access any said data server, or the longest response time for any said client to access any said data server and a proportion of the average of the response times for all said data servers, or as a function of the rates at which data can be retrieved by said clients from said data servers, the rates at which

data can be updated by said clients at said data servers, the contention between said clients for accessing said data servers, and communications times between said clients and said data servers.

a 16. Data processing apparatus according to Claim 12 ~~any one of claims 12 to 15~~ including monitoring means for monitoring the passage of data over the network, wherein said first determining means is adapted to use the output of said monitoring means to determine said cost values, and said control means is adapted to adaptively configure the distributed database.

a 17. Data processing apparatus according to Claim 1 ~~any one of claims 1 to 9~~, further comprising control means for configuring a distributed processing system, the distributed processing system comprising a plurality of servers connected over a network, each server being capable of carrying out any number of processing operations, and a plurality of clients connected over the network to the servers, each of said clients being adapted to request processing to be carried out by one or more of the servers, wherein the parameters of the model to be optimised include configuration parameters defining which server is to be accessed by which client, and the first determining means is arranged to utilise the configuration parameters and information on the communications speed within the distributed processing system to determine a cost value, the control means being arranged to control which server is to be accessed by which client in accordance with determined optimum configuration parameters.

18. Data processing apparatus according to claim 17, wherein said first determining means is adapted to determine said cost value in dependence upon the transaction times by said servers.

19. Data processing apparatus according to claim 18 wherein said first determining means is adapted to determine said cost value as any one of: the longest transaction time by any said server, or the longest transaction time by any said data server and a proportion of the average of the transaction times for all said servers.

20. Data processing apparatus according to claim 17 ~~any one of claims 17 to 19~~ including monitoring means for monitoring the transaction times of said servers, wherein said first determining means is adapted to use the output of said monitoring means to determine said cost values, and said control means is adapted to adaptively configure the distributed processing system.

21. A processor implemented method of determining optimum parameters of a model of a physical system, the method comprising:

(a) obtaining at least one initial string of values representing the parameters of the model to be optimised;

(b) determining a cost value associated with the model having parameters represented by the or each string of values;

(c) repeatedly generating a new string of values by selecting a sequence of values of random length

starting at a random position in a said string of values, replacing a sequence of values of the same length in a said string of values at a random position, and changing the value of one or more of the values of the resulting string of values to generate a new string of values;

(d) determining a cost value associated with the model having parameters represented by the new string of values; and

(e) determining the optimum parameters as one of said initial or new string of values for which the cost value is closest to a target.

22. A method according to claim 21, wherein in the generating step a last value in a said string of values is considered as being sequential to a first value in said string of values such that said selected sequence of values can include said last and first values sequentially in a said string of values and the sequence of values to be replaced can include said last and first values sequentially in a said string of values.

23. A method according to claim 21 ~~or claim 22~~, wherein the values for said at least one initial string of values is randomly obtained.

24. A method according to claim 21 ~~any one of claims 21 to 23~~, wherein a plurality of said initial strings of values are obtained to form a population, and the repeated generating step comprises selecting a sequence of values of random length starting at a random position in a first said string of values, replacing a sequence of values of

the same length in a second said string of values, and changing the value of one or more of the values of the resulting string of values to generate said new string of values.

25. A method according to claim 24, including repeatedly:
(a) deleting a proportion of the population for which the cost value is furthest from said target;
(b) performing said repeated generating step until the population is regenerated; and
(c) selecting said first and second strings of values randomly from the proportion of the population for which the cost values are closest to said target.

26. A method according to claim 24 including repeatedly:
(a) randomly selecting three said strings of values from said population
(b) selecting two of the selected strings of values for which the cost values are closest to said target as said first and second strings of values for use in the generating step; and
(c) replacing the third of said selected string of values with the generated new string of values.

27. A method according to claim 21 ~~any one of claims 21 to 23~~, wherein a single said initial string of values is obtained as a parent string of values, and the repeated generating step comprises selecting a sequence of values or random length starting at a random position in said parent string of values, replacing a sequence of values of the same length in said parent string of values at a random position, and changing the value of one or more of the values of the

resulting string of values to generate said new string of values.

28. A method according to claim 27, including repeatedly replacing said parent string of values with said new string of values if the cost value for said new string of values is closer to said target.

29. A method according to claim 28, including repeatedly replacing said parent string of values with said new string of values if the exponential of the difference in the cost values for said parent and new strings of values divided by as factor dependent upon the number of repetitions of the generating step is greater than a randomly generated number between 0 and 1.

30. A method according to Claim 21 ~~any one of claims 21 to 29~~, including applying the method to configure a physical system in which the parameters include configuration parameters of a physical system, the configuration including controlling a physical system in accordance with determined optimum configuration parameters.

31. A method according to claim 30, including receiving operating parameters from said physical system, wherein the determining step includes using the received operating parameters to model said physical system.

32. A method according to Claim 21 ~~any one of claims 21 to 29~~, including applying the method to configure a distributed database comprising a plurality of data servers connected over a network, each data server holding any number of

data units, and a plurality of clients connected over said network to said data servers, each of said clients being adapted to retrieve data units from and/or update data units at one or more of the data servers, in which the parameters of the model to be optimised include configuration parameters defining which data server is to be accessed by which client, said configuration of the distributed database including controlling which data server is to be accessed by which client in accordance with determined optimum configuration parameters.

33. A method according to claim 32, wherein configuring the distributed database comprises copying, moving and/or deleting data units at data servers to change the distribution of data units across the data servers, and/or changing the data servers to be accessed by said clients using the determined optimum configuration parameters to improve the system performance.

34. A method according to claim 32 ~~either of claims 32 or 33~~, wherein said cost values are determined in dependence upon the time taken for one or more said clients to retrieve and/or update data units at one or more data servers.

35. A method according to claim 34, wherein the cost value is determined as any one of: the longest response time for any said client means to access any said data server, or the longest response time for any said data server and a proportion of the average of the response times for all said data servers, or as a function of the rates at which data can be retrieved by said clients from said data servers, the rates at which data can be updated by said

clients at said data servers, the contention between said clients for accessing said data servers, and communication times between said clients and said data servers.

36. A method according to claim 32 ~~any one of claims 32 to 35~~ including the step of monitoring the passage of information over the network, wherein the cost value is determined in accordance with the monitoring, and the configuration of the distributed database is adaptively controlled.

37. A method according to Claim 21 ~~any one of claims 21 to 29~~, including applying the method to configure a distributed processing system comprising a plurality of servers connected over a network, each server being capable of carrying out any number of processing operations, and a plurality of clients connected over said network to said servers, each of said client being adapted to request processing to be carried out by one or more of the servers, in which the parameters of the model to be optimised include configuration parameters defining which server is to be accessed by which client, and the configuration including controlling which server is to be accessed by which client in accordance with determined optimum configuration parameters.

38. A method according to claim 37, wherein said cost value is determined in dependence upon the transaction time taken for said servers.

a 39. A method according to Claim 37 ~~either claims 37 or 38~~, including the step of monitoring the transaction times of said servers, wherein the cost value is determined in accordance with the monitoring, and the configuration of the distributed processing system is adaptively controlled.

40. A storage medium storing processor implementable instructions for controlling a processor to carry out the
a method of Claim 21 ~~any one of claims 21 to 39~~.

41. An electronic signal carrying computer code for
a controlling a processor to carry out the method of Claim 21 ~~any~~
a ~~one of claims 21 to 39.~~